Hydrodynamic linear stability of the two-dimensional bluff-body wake through modal analysis and initial-value problem formulation

Power Grid Complexity

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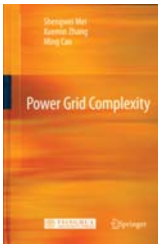
Power Grid Complexity

Shengwei Mei, Xuemin Zhang, and Ming Cao
Springer, New York, and Tsinghua U. Press, Beijing, 2011. $239.00 (471 pp.). ISBN 978-3-642-16210-7

One of the most pressing challenges for power grid engineers involves integrating renewable energy sources into the globally interconnected network of power sources and sinks, which is now powered mostly with nonrenewables. Addressing the challenge promises economic dividends too, because the more adaptive energy web will allow power providers to better manage the fluctuations in energy demand and supply that will arise from climate variability or critical events of any origin. Economist and writer Jeremy Rifkin has coined the term "third industrial revolution" to describe this ongoing global transformation of the way energy is produced, distributed, used, bought, and sold.



At the heart of attempts to develop the "emerging energy web" is the field of networked energy systems, which represents a convergence of complexity science, risk management, information and communication technologies, and electrical grid engineering. *Power Grid Complexity* by Shengwei Mei, Xuemin Zhang, and Ming Cao is a timely and largely successful attempt to organize the various components of that multidisciplinary field. This book will provide researchers and professionals in the field with a comprehensive and valuable reference covering the main concepts and tools. Although the listed price is steep compared with that of a typical physics text, researchers will certainly appreciate the effort to gather those key topics together for the first time. Moreover, the book might also be useful for professionals working in power companies. But because the field is evolving rapidly, it might soon become obsolete if the authors do not prepare an updated edition.

Power Grid Complexity is organized into 14 chapters. Chapter 1 offers a well-balanced introduction. Chapter 2 provides an overview of the basic concepts and methods of statistical physics—in particular, the chapter covers complexity-science methods and their utility in investigating and managing power grids. The remaining chapters are dedicated to technical aspects of the power grid complexity and to grid engineering and management. Some critical topics covered include self-organization phenomena, power grid growth and evolution, blackout modeling, vulnerability assessments, and emergency management.

Power grid complexity is an active area of research. But it is cross-disciplinary and still far from reaching its maturity. The contributing parent disciplines—the most important being complexity science and engineering—have progressed independently over the past several decades, but the book lacks some of the deep insights gathered from those parent disciplines. That lack is especially evident in chapter 2. And in several other chapters, the thread connecting complexity-science concepts and power grid engineering does not always shine through.

The field is also rapidly developing, and *Power Grid Complexity* understandably fails to cover some recent advances or to provide perspective on the field's social, economic, and geopolitical dimensions. That is the unavoidable fee readers should be prepared to pay for a book inspired by a global challenge that impacts issues as diverse as growing energy demand, climate change, socioeconomics, and technological development.

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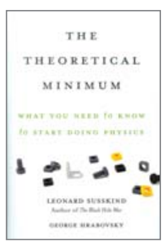
The Theoretical Minimum

What You Need to Know to Start Doing Physics

Leonard Susskind and George Hrabovsky
Basic Books, New York, 2013. $26.99 (238 pp.). ISBN 978-0-465-02811-5

I was pleased to have the opportunity to review *The Theoretical Minimum: What You Need to Know to Start Doing Physics*. The book's authors hail from different backgrounds: Leonard Susskind is a well-known theoretical physicist at Stanford University; George Hrabovsky is a self-described "'professional' amateur scientist" and president of Madison (Wisconsin) Area Science and Technology, a nonprofit organization for amateur scientists. Having read several of Susskind's other books with great pleasure, I anticipated that this book would be similarly enjoyable and useful.



Enjoyable it was, but its utility is narrower than I might have hoped. In fairness, it seems to be excellent for its stated purpose: as a first textbook for the "ardent amateur" who is perhaps taking a continuing education course or seeking to learn about physics at a level a bit higher than in the usual gee-whiz, calculus-free course. I, however, was eager to analyze the book as a supporting resource for mechanics courses for two different classes of amateurs: life-science students taking physics as a premedical requirement and engineering or physics students with a comparatively weak background. There is a chronic need for a clearly written "theoretical minimum" textbook to help the many students who try to learn physics but cannot remember, or who never properly learned, the necessary elementary math skills—not to mention students whose high school physics course was so poor it actually obstructed their conceptual understanding.

The first half of the book would be useful to life science students taking a calculus-based introductory physics class, such as the one I teach at Duke University. Indeed, I really like chapter 1, The Nature of Classical Physics, which presents a low-level conceptual picture of dynamical processes that transcends mechanics. It reminds me of Julian Schwinger's *Quantum Kinematics and Dynamics* (paperback reprint, Westview Press, 2000), which equally brilliantly reduces the concept of a system's state and its measurement to a geometry of the former and an algebra of the latter. Most of the next few chapters—the authors call them "lectures"—are a nice mix that introduces readers to some of the calculus and trigonometry needed to do Newtonian dynamics.

I could definitely see those lectures being beneficial to introductory physics students—if they didn't rapidly advance to partial derivatives and real mechanics. For example, a short section covers the Lagrangian and Hamiltonians appropriate for electrodynamics at a level completely inaccessible to first-year college students trying to learn either mechanics or electricity and magnetism, and it is written in a style too terse to be particularly useful to a second-year physics major.

While I was working through the book, one of my advisees was struggling in a mechanics course that covered Hamiltonians, Lagrangians, and